Laid-Open Publication

DE 195 17 590 A1

Gas Exchange Control for Internal Combustion Engines made possible by means of Control Pistons and Adjustable Crank Drive of the variable Control Times and variable Compression Ratios

Gas exchange control for internal combustion engines by means of control pistons, with which a change of the control times and additionally of the compression ratio is also possible during operation of the same by turning an eccentric on which a linkage connecting rod abuts and which changes the angular position of a double connecting rod, by means of which there is earlier or later release of the control slits by means of the upper edge of the piston, or the combustion chamber of the engine is enlarged or reduced.

Description

The further tightening of the emission limit values expected for passenger vehicles and the no less necessary reduction of carbon dioxide emissions can only be achieved by reducing fuel consumption.

In particular during partial load operation, i.e. the operation in which vehicles are predominantly operated, there is still considerable potential for savings if one adapts the control times and the compression ratio of engines to the changing numbers of revolutions, i.e. to the different circumstances, both formed variably. One will not be able to avoid the associated additional constructional cost.

The first faint-hearted attempts have meanwhile been made in this direction: a few engine manufacturers have produced variable control times with large-volume engines in serial production, even if only the control times have been shifted in relation to one another, and in another case a double valve has been shut down. For variable compression there is still no development, not even a useful suggestion, although just the combination of both measures evidently produces the greatest synergy effect.

Responsible for this unsatisfactory situation is surely the adherence to the valve, along with its many disadvantages, as the only control component used in production with combustion engines. There are numerous proposals here for rotary slide valve controls which are far more advantageous and could be technically mastered nowadays. No worse is gas exchange control by means of control pistons, which technically do not pose any problems, but only the greater constructional cost has stood in the way of series production up until now.

The valve which is simple, and therefore cheap to produce, no longer satisfies the future demands, however. The hydraulic valve control which could possibly be adopted, is one way, but this version is also no longer simple and

inexpensive, and makes alternatives such as rotary slide valves and control pistons appear interesting and competitive.

Described in the following is a gas exchange control for internal combustion engines by means of control pistons which make possible both variable control times and variable compression ratios during operation.

Building on patent application No. 195 04 735.4 for a crank drive for changing the compression ratio by means of the working piston, in the same way the crank drive of the control pistons is provided with additional linkage rods, the adjustment of which by means of eccentrics brings about adjustment of the control piston stroke. The control pistons thus undertake the change to the compression ratio, whereby this modification on the working piston can be dispensed with. At the same time, by adjusting the piston stroke, the control times of the inlet and outlet are also changed, i.e. shortened or extended, and so can be adapted to the different numbers of revolutions and ratios of the engine.

Control of the gas exchange – without adjustment – by means of slits and the upper edge of the piston, is implemented in principle as with two-stroke engines, only that here there is a piston for the inlet and for the outlet, and which are reciprocated with the half revolution of the working piston. A third piston, namely that for the compression chamber and the seat of the spark plug – in the Otto engine and the injection nozzle in the diesel engine – is necessary in order to keep the space, which these pistons form when moving, constant at all times.

A mathematical law states that three sinus waves respectively out of phase by 120° always result in the sum of 0 when added up. As well as the space formation, this applies in the same way to the gas forces which are exerted upon the control pistons. The deviation of this in the crank drive due to the final connecting rod length can be disregarded because it has no serious effect.

With a slightly inclined position of the control pistons, all 3 pistons can be operated by the control crank [cam?] shaft disposed in the head. The control crank shaft can be connected to the working crank shaft, optionally with toothed wheels, chain, cogged belt, etc, as already mentioned, with the ratio 2 : 1 (**Fig. 1**).

If one wishes to change the inlet and outlet times independent of one another and in relation to one another, instead of a common crank shaft, two of the same can be provided. Shifting the control times can be undertaken in the same way as with the cam shaft adjustment with valve engines (**Fig. 2**).

4 pistons were drawn here, i.e. instead of one compression chamber piston, two of the same, and this means that these two pistons must only have half the stroke of the control pistons, or only half the piston diameter respectively (**Fig. 3**).

Of course more than 3 or 4 pistons can also be provided (**Fig. 4**).

It is also conceivable to dispose the compression chamber piston in the control piston which can then have the same diameter as the working piston (processing advantage) (**Fig. 5**).

Patent Claim

Gas exchange control for single or multi-cylinder combustion engines, **characterised in that** the crank drive of the control pistons is provided with an additional, adjustable linkage rod with which it is possible to change the compression ratio and the control times during operation.

6 pages of drawings attached

Key to the Figures

Fig. 4

alternative Mittelachse = alternative centreline

Control diagram for Figs. 1 and 2

Kurbelwinkel = crank angle

Steuerkolbenwege = control piston paths

Arbeitskolbenweg = working piston path

Final page

öffnet = opens

shließt = closes

Auslaß groß = oulet large

Auslaß klein = outlet small

Hub = stroke

Hubverschiebung = stroke displacement

Einlaß also nur um 240° Kurbelwinkel versetzt = inlet therefore only offset by 240° crank angle

Steuerquerschnitte Veränderung = control cross-sections change